CULTIVAR DIFFERENCES IN BIRD DAMAGE TO CHERRIES

MARK E. TOBIN, New York Fish and Wildlife Research Unit, Cornell University, Hudson Valley Laboratory, P.O. Box 727, Highland, NY 12528

RICHARD A. DOLBEER, U.S. Department of Agriculture, Denver Wildlife Research Center, 6100 Columbus Avenue, Sandusky, OH 44870

CAROL M. WEBSTER,² New York Fish and Wildlife Research Unit, Cornell University, Hudson Valley Laboratory, P.O. Box 727, Highland, NY 12528

THOMAS W. SEAMANS, U.S. Department of Agriculture, Denver Wildlife Research Center, 6100 Columbus Avenue, Sandusky, OH 44870

Although birds cause substantial damage to ripening sweet cherries (Brown 1974, Guarino et al. 1974, DeHaven et al. 1979), the relative susceptibility of different cultivars has not been well documented. While investigating other aspects of bird damage in cherry orchards in 1986 and 1987 (Tobin and Dolbeer 1987, Tobin et al. 1989a), we noticed that damage with-

in orchards consistently seemed to be greatest to early-ripening cultivars (Table 1). However, because these studies entailed assessing damage only once, before the beginning of harvest of the earliest cultivars, they may have underestimated the amount of damage to cultivars that ripened later. The sweet cherries in most of the orchards in these studies were harvested over a period of 2 weeks or more after our assessments, during which birds continued feeding on the cherries. Thus, damage to latermaturing cultivars may have increased substantially by the end of harvest. The present

¹ Present address: U.S. Department of Agriculture, Denver Wildlife Research Center, P.O. Box 10880, Hilo, HI 96721.

² Present address: 111 Lukia Place, Hilo, HI 96720.

	Mean harvest	Number of	Number of trees	Percent of cherries damaged per tree	
Cultivar	date ^b	orchards	sampled	x	SE
Early River	Pc	1	1	100.0	
Geneva 1495	5 June	1	2	60.5	21.5
Black Tartarian	11 June	1	1	27.3	
Geneva 1512	13 June	1	2	0.5	0.6
Vista	16 June	1	1	18.8	
Vernon	17 June	1	1	0.7	
Hardy Giant	20 June	1	6	9.6	19.8
Schmidt	21 June	3	46	7.9	14.9
Ulster	24 June	2	33	11.7	16.2
Noble	25 June	1	2	2.5	1.0
Windsor	26 June	3	30	6.1	7.1
Hedelfingen	27 June	4	30	3.7	7.5
3	•		Grand mean	20.8	8.7

Table 1. Percentage of cherries of various cultivars damaged by birds in the mid-Hudson Valley of New York, 1987 (M. E. Tobin, unpubl. data^a).

study was conducted to document more accurately differences among cultivars in damage by birds.

METHODS

In 1988 bird damage was assessed in 7 cherry orchards in the mid-Hudson Valley of New York in conjunction with an evaluation of a chemical bird repellent. Orchards varied in size from 0.2 to 1.6 ha and contained 3 or more cultivars of sweet cherries. The chemical bird repellent 3,5-dimethyl-4-(methylthio)phenyl methylcarbamate (methiocarb) was applied at the rate of 1.7 kg (AI)/ha to ½ of each orchard 4-13 days before damage to the earliest ripening cherries was assessed. Approximately equal numbers of treated and untreated trees were sampled within each orchard for each cultivar.

Thirty-two trees were selected at random for assessment of damage in each methiocarb-treated and control block at each orchard. The limited distribution and scarcity of some cultivars precluded a balanced experimental design with regard to cultivar and orchard. The lack of replication of all cultivars in all orchards prevented us from taking a stratified random sample. Damage was assessed 1-3 days before the scheduled harvest for each cultivar. Some trees selected for sampling were harvested earlier than scheduled and could not be assessed for damage. Damage to each tree was assessed by randomly selecting portions of 2 branches and counting the number of (1) cherries pecked but not totally removed by birds, (2) empty stems, and (3) undamaged cherries (Tobin et al. 1989a). Any stems with missing cherries were assumed to be due to bird depredations (Bukovac 1971).

Four counts of birds were conducted at each orchard: 2 within 7 days before the earliest cultivar was assessed for damage, and 2 more before the latest cultivars were assessed. During each count an observer stood for 15 minutes at each of 2 vantage points on the periphery of the orchard and recorded the numbers and species of birds flying into the orchard. At the end of the count, the observer slowly walked down 2 rows selected at random and recorded all birds heard or seen in the orchard. All counts were conducted within 4 hours of sunrise.

RESULTS

Birds pecked or removed an average of 13.5% (SE = 2.8) of the total crop at each orchard. The average percent of cherries damaged in the blocks sprayed with methiocarb was 14.1%. compared to 12.9% in the unsprayed blocks (t = 0.24, 6 df, P > 0.50) (Table 2). Data from treated and untreated trees were pooled for subsequent analyses.

Damage ranged from 0% to 86.5% among the 17 cultivars, with an overall average of 15.4% per cultivar (Table 3). Each of the 3 cultivars that ripened earliest ("Early June," "Governor Wood," and "Black Tartarian") had higher percent losses ($\bar{x} = 62.0\%$) than any of the 14 cultivars that ripened later ($\bar{x} = 5.5\%$).

Fifteen species of frugivorous birds were ob-

See Tobin et al. 1989a for methods.

b These are overall means for all orchards in the mid-Hudson Valley in 1987 (S. Brown, Cornell Univ. Dep. of Hortic. Sci., pers. commun.). Assessment and harvest dates varied among all orchards.

Consistently heavy bird damage to this early-ripening cultivar has prevented the determination of a precise ripening date.

Table 2. Average percent of cherries damaged by birds on methicarb-treated and untreated blocks at each of 7 orchards in the mid-Hudson Valley of New York, 1988.

	Percent of cherries damaged per tree			
Orchard	Methiocarb- treated block	Untreated block		
1	17.5	12.9		
2	12.1	35.6		
3	25.1	5.2		
4	11.7	10.7		
5	4.3	2.7		
6	24.1	16.7		
7	3.9	6.5		
Grand mean	14.1 ^a	12.9^{a}		

 $^{^{\}circ}$ Mean percent damage did not differ between methiocarb-treated and untreated blocks (t = 0.24, 6 df, P > 0.50).

served in the orchards during the bird counts (Table 4). The most frequently recorded species were house finches (Carpodacus mexicanus), American robins (Turdus migratorius), and European starlings (Sturnus vulgaris). The total number of birds of all species did not vary significantly (P > 0.05, Wilcoxon's signed ranks test) between counts 1–2 and 3–4, indicating that bird populations using orchards were relatively constant during the study.

DISCUSSION

The similar damage in the treated and untreated blocks indicates that the methiocarb applications had little effect on the relative damage to the various cultivars. The lack of any significant difference due to the repellent was unexpected, because the same application rate deterred birds in a previous study (Tobin and Dolbeer 1987).

The disproportionate amount of damage in 1988 to "Early June," "Governor Wood," and "Black Tartarian" cherries confirmed our suspicions that the severe damage to early-ripening cultivars during the previous year (Table 1) was due to heavy foraging pressure by birds and was not simply an artifact of when we assessed damage. The scarcity of some cultivars and their lack of replication in all orchards

Table 3. Percentage of cherries of various cultivars damaged by birds in the mid-Hudson Valley of New York, 1988.

	Mean harvest	Number of	Number of trees	Percent of cherries damaged per tree	
Cultivar	date*	orchards	sampled	ű	SE
Early June	15 June	1	4	86.5	8.6
Governor Wood	17 June	1	4	39.5	12.1
Black Tartarian	25 June	5	19	60.0	8.0
Geneva 3308	28 June	1	3	0.0	0.0
Vista	30 June	2	3	2.0	2.0
Vernon	1 July	1	2	0.0	0.0
Hardy Giant	4 July	1	6	1.0	0.4
Schmidt	5 July	6	112	7.7	1.9
Emperor Francis	5 July	1	1	0.0	
Sam	5 July	2	10	22.4	12.8
Stella	5 July	1	5	3.6	2.7
Ulster	8 July	5	70	16.8	2.9
Black Giant	9 July	3	3	0.3	0.3
Van	9 July	1	1	0.0	
Noble	9 July	1	4	1.8	1.8
Windsor	10 July	5	43	11.7	3.2
Hedelfingen	11 July	7	111	9.2	1.6
		Grand	mean	15.4	6.0

^a These are overall means for all orchards in the mid-Hudson Valley in 1988 (S. Brown, Cornell Univ. Dep. of Hortic. Sci., pers. commun.). Assessment and harvest dates varied among orchards.

notwithstanding, our data consistently show that in the mid-Hudson Valley early cultivars are more susceptible to damage by birds than are late-ripening cultivars. Virgo (1971), while studying bird damage in the Niagara Peninsula of Canada, also reported that damage was most severe on early-ripening cultivars. However, Brown (1974) concluded that high variability in bird damage among years and orchards in the Niagara Peninsula precluded predicting damage for particular cultivars.

Various factors may influence the relative amount of bird damage among different cherry cultivars. For instance, cultivars that ripen next to a large colony of birds or when large flocks of migratory birds are in the area may receive heavy damage (Brown 1974). However, no such congregation of birds was seen during this study. Some cultivars might sustain higher damage simply because they are near other, highly preferred cultivars. The cultivars

Table 4. Mean number of birds recorded during 30-min observation periods and flushed from transects at each of 7 cherry orchards, mid-Hudson Valley, New York, 1988.

Assessment period	Number of observations	House finch	American robin	European starling	Common grackle	All other	Total
16-27 June	14	12.1	11.6	11.9	2.6	7.1	45.3 ^b
23 June-2 July	14	14.4	8.7	6.2	4.1	8.9	42.3 ^b

^{*} Other species included blue jay (Cyanocitta cristata), northern mockingbird (Mimus polyglottos), common flicker (Colaptes auratus), red-winged blackbird (Agelaius phoeniceus), rose-breasted grosbeak (Pheucticus ludovicianus), American goldfinch (Carduelis tristis), eastern bluebird (Sialia sialis), gray catbird (Dumetella carolinensis), house sparrow (Passer domesticus), American crow (Corvus brachyrhynchos), and eastern kingbird (Tyrannus tyrannus).
b Not significantly (P > 0.05) different, Wilcoxon's signed-ranks test.

that received the most damage in this study generally were distributed evenly throughout their respective orchards, and we detected no systematic bias with regard to their locations. Color of fruit is an important cue to frugivorous birds assessing a fruit's ripeness and nutritive value (Turček 1963, Snow 1971), and in some instances dark cultivars of cherries are preferred by birds (Stevens and De Bont 1980). The cultivars in this study showed no consistent differences with respect to color and damage. In fact, "Early June," the cultivar with the most damage, acquired only a slight blush of red when ripe. Sugar concentration (Levey 1987, Schuler 1983) and type (Schuler 1983, Martinez del Rio et al. 1988), fat content (Borowicz 1988), and other nutritive factors (Johnson et al. 1985) also might be important in avian fruit selection, but assessing their influence is beyond the scope of this study.

Of the factors we investigated, time of ripening was the one most closely associated with bird damage. A similar pattern of bird damage has been observed with early-ripening grapes (Stevenson and Virgo 1971), apples (Mitterling 1965, Baker 1980, Tobin et al. 1989b), and field corn (Bridgeland and Caslick 1983). Because "Early June," "Governor Wood," and "Black Tartarian" ripened before any other cultivars and were the only fruit available in the orchards at this time, birds may have concentrated their feeding on these cultivars. Later, as other cultivars ripened, damage perhaps was spread more evenly throughout the orchards.

A management implication from this study is that growers might increase the cost effec-

tiveness of bird control programs while reducing pesticide use in their orchards by focusing efforts on the early, susceptible cultivars. For example, although the cost of protecting an entire orchard with bird-exclusion netting would be prohibitive, netting a few early-ripening trees might be practical. As another example, the amount of methiocarb or other chemical bird repellent applied per hectare could be greatly reduced if only highly susceptible trees in an orchard were treated. This strategy would reduce costs and, perhaps more importantly, chemical residue levels which currently are of concern to the U.S. Environmental Protection Agency (Tobin and Dolbeer 1987). (The proprietary company recently withdrew the registration of methiocarb, and the future status of this chemical is uncertain.)

Acknowledgments.—The growers in the mid-Hudson Valley of New York kindly allowed us to study their orchards. C. Andola, C. Carver, M. Castaldi, T. Chiarot, and C. White assisted with the damage assessments. S. Brown of the Cornell University Department of Horticultural Sciences provided information about the characteristics of different cherry cultivars.

LITERATURE CITED

BAKER, R. T. 1980. Bird damage to apples. Orchardist N.Z. 53:145–146.

Borowicz, V. A. 1988. Fruit consumption by birds in relation to fat content of pulp. Am. Midl. Nat. 119:121–127.

BRIDGELAND, W. T., AND J. W. CASLICK. 1983. Relationships between cornfield characteristics and blackbird damage. J. Wildl. Manage. 47:824–829.

- Brown, R. G. B. 1974. Bird damage to fruit crops in the Niagara Peninsula. Can. Wildl. Serv. Rep. Ser. 27. 56pp.
- Bukovac, M. J. 1971. The nature and chemical promotion of abscission in maturing cherry fruit. HortScience 6:385–388.
- DeHaven, R. W., D. F. Mott, J. L. Guarino, J. F. Besser, C. E. Knittle, and E. W. Schafer, Jr. 1979. Methiocarb for repelling birds from ripening sweet cherries. Int. Pest Control 21:12-14, 21.
- GUARINO, J. L., W. F. SHAKE, AND E. W. SCHAFER, JR. 1974. Reducing bird damage to ripening cherries with methiocarb. I. Wildl. Manage. 38:338–342.
- with methiocarb. J. Wildl. Manage. 38:338–342. JOHNSON, R. A., M. F. WILLSON, J. N. THOMPSON, AND R. I. BERTIN. 1985. Nutritional values of wild fruits and consumption by migrant frugivorous birds. Ecology 66:819–827. Levey, D. J. 1987. Sugar-tasting ability and fruit se-
- Levey, D. J. 1987. Sugar-tasting ability and fruit selection in tropical fruit-eating birds. Auk 104:173–179
- MARTINEZ DEL RIO, C., B. R. STEVENS, D. E. DANEKE, AND P. T. ANDREADIS. 1988. Physiological correlates of preference and aversion for sugars in three species of birds. Physiol. Zool. 61:222–229.
- MITTERLING, L. A. 1965. Bird damage on apples. Proc. Am. Soc. Hortic. Sci. 87:66–72.
- Schuler, W. 1983. Responses to sugars and their behavioural mechanisms in the starling (Sturnus vulgaris L.). Behav. Ecol. Sociobiol. 13:243–251.

- Snow, D. W. 1971. Evolutionary aspects of fruit-eating by birds. Ibis 113:194–202.
- STEVENS, J., AND A. F. DE BONT. 1980. Choice by starlings (Sturnus v. vulgaris L.) among different cherry cultivars. Agricultura 28:421-436.
- STEVENSON, A. B., AND B. B. VIRGO. 1971. Damage by robins and starlings to grapes in Ontario. Can. J. Plant Sci. 51:201–210.
- TOBIN, M. E., AND R. A. DOLBEER. 1987. Status of Mesurol as a bird repellent for cherries and other fruit crops. Proc. East. Wildl. Damage Control Conf. 3:149-158.
- nate-row treatment with the repellent methiocarb to protect cherry orchards from birds. Crop Prot. 8:461–465.
- ——, ——, AND P. P. WORONECKI. 1989b. Bird damage to apples in the mid-Hudson Valley of New York. HortScience 24:859.
- Turček, F. J. 1963. Color preference in fruit- and seed-eating birds. Proc. Int. Ornithol. Congr. 13: 285-292.
- Virico, B. B. 1971. Bird damage to sweet cherries in the Niagara Peninsula, Ontario. Can. J. Plant Sci. 51:415-423.

Received 5 September 1989. Accepted 12 December 1990.

